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Title of the Invention: Method for Production of Packages from Stacks Consisting of Creped Sheets of Cellulose Fibers, Apparatus for Performance of the Method and Package Produced According to This Method.

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MAIN PATENT

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Method for production of packages from stacks consisting of creped sheets of cellulose fibers, apparatus for performance of the method and package produced according to this method.

The invention relates to a method for production of packages from stacks consisting of creped sheets of cellulose fibers, an apparatus for performance of this method and a package produced according to this method.

The method according to the invention consists of subjecting the stack to compression at right angles to the rib-like elevations formed by creping with at least approximate maintenance of the height and width of the stack, whereupon a first wrapping and then a second wrapping over this are placed around the stack, so that the longitudinal direction of the first wrapping runs parallel to the rib-like elevations of the sheets of the stack, while the longitudinal direction of the second wrapping runs at right angles to the mentioned rib-like elevations and the compressed package retains its flat shape in the compressed state, but that after opening of the package, the individual sheets can be restored to their original form before compression.

The apparatus for production of packages according to the method according to the present invention is characterized by a compression device for compression of a stack passed through the latter, a pair of clamping devices arranged behind the outlet site of the compression device to accommodate the stack after leaving the compression device and to apply a first

wrapping, and a second pair of clamping devices to accommodate the compressed stack provided with first wrapping and to apply a second wrapping.

The package produced according to the method of the invention is characterized by the fact that it has a first wrapping, consisting of a sheet-like material lying across the direction of the rib-like elevations of the sheets of the stack, around which a second wrapping made of a sheet-like material is placed, whose longitudinal direction lies at right angles to the longitudinal direction of the first wrapping, so that the first wrapping counteracts expansion of the stack, while the second wrapping counteracts a shape change, in order to keep the compressed, wrapped stack flat.

A variant of the apparatus for performance of the method according to the present invention, as well as a package produced by means of this apparatus, are shown in the drawing.

Fig. 1 shows a top view of the apparatus,

Fig. 2 shows a section along line 2-2 in Fig. 1,

Figs. 3, 4, 5 and 6 each show a section along line 3-3 or 4-4 or 5-5 or 6-6 in Fig. 1 on a larger scale,

Fig. 7 shows a compressed stack of superimposed sheets before packing,

Fig. 8 shows a stack during packing, and

Fig. 9 shows a view of a finished package, partially in cross-section, to make its structure visible.

Figs. 10 and 11 depict a finished package according to a detail variant, partially in cross-section, to make the package structure visible.

A stack 11 to be packed is shown in Fig. 7, which is formed from a plurality of superimposed sheets 13, as is particularly apparent in the enlarged cutout shown in Fig. 7. These sheets 13 are sheets that are creped, where the more or less strongly pronounced ribs formed by creping of all sheets run in the same direction. For example, let us assume that the weight of 480 individual sheets, measuring 61 × 91 cm, varies between 1.8 and 4 kg. Such products contain about 95% pure cellulose fibers, if they are to be used for medical purposes. The sheets 13 are produced with a known machine. Creping is appropriately conducted, so that the length of a smooth sheet is shortened to about 2/3. Shortening, however, could also occur in a different ratio.

To form a stack 11, a specified number of sheets 13 are placed one on the other, so that the rib-like elevations formed by creping come to lie across the longitudinal direction of the sheets. The stack 11 is then subjected to compression in the longitudinal direction, in which case the height of the stack remains essentially unchanged, but the density of the stack increases with a reduction of its length. This compression is carried out with a known device.

If such sheets are to be used for medical purposes, they must be packed fully air-tight to maintain sterility.

The flat state of a stack is supposed to be retained in the desired compressed state even after packing. Satisfactory fulfillment of these conditions is only possible by overcoming certain difficulties, since the compressed stack has a tendency to expand again in the direction from which shortening occurred by compression.

The device shown in Fig. 1, used to produce packages from such stacks 11, has a compression device, by means of which the stack is subjected prior to packaging again to a controlled compression. Means are also provided that cause the stack to retain the shape assumed after compression is completed when it leaves the compression device and is then provided with an internal wrapping. Additional means serve to maintain the shape of the stack after application of the internal wrapping and during application of an external wrapping.

The stacks 11 already subjected to pre-compression, after they have been cut to the desired length, are fed to a work table 17 (Fig. 1). Since they can expand again on the way, repeated compression of the stack is necessary, so that the density and dimensions that the stacks are supposed to have during packing are obtained.

The compression device mounted on table 17 has a wedge-like compression mold 19 acting like a nozzle with a rectangular cross-section, through which the stack 11 is passed by means of two endless belts 21. These two belts 21 represent two sides of the wedge-like compression mold 19. Two polished metal plates 23 and 25 form the bottom and upper side of the compression mold. The upper plate 23 is provided with a cutout 27, having a circular cross-section at the entry location, and is also bent out somewhat from the plane of the plate, as shown in Fig. 1 and 2, to facilitate entry of the stack 11 between the two plates 23 and 25.

The two belts 21 are formed from any known material. The belt width corresponds to at least roughly the spacing between the two plates 23 and 25. The belts are positioned over guide rollers 29 and driven by means of known drive devices (not shown), so that they move with the

same constant speed. The two belts 21 lie along the compression mold on a guide rail 31, by means of which straight guiding without unduly strong belt tension is achieved, since a relatively high force is required to achieve the required compression work. The guide rails 31 could also be omitted, if the belt tension can be chosen high enough that straight guiding along the two sides of the compression mold can be achieved.

The compressed stacks 11 emerging from the compression mold 19 are taken up by a holding device, formed from two parallel, flat jaws 33 and 35 made of sheet metal and provided with Y-shaped cutouts 37 that facilitate grasping and removal of the compressed stack 11 for application of the internal wrapping. Fig. 2 and 3 show details of these jaws 33 and 35. The lower jaw 35 is firmly mounted on one end and its upper side lies in the plane of the upper side of the bottom plate 25 of the compression device 19. The two longitudinal edges of the lower jaw 35 are bent upward, as shown in Fig. 3, where the width of these bent side parts 39 corresponds at least roughly to the final thickness or height of stack 11. The upper jaw 33, on the other hand, has downward bent longitudinal edges serving to form side parts 41, which lie on the outer surfaces of the side parts 39 of lower jaw 35, as shown in Fig. 3. The upper jaw 33 can be moved toward the lower jaw 35 or away from it. For this purpose, its rear end is attached pivotably, by means of a pin 43, on two supports 45 arranged on table 17. The upper jaw 33 is also under the influence of controllable springs 47, which attempt to pivot the jaw 43 in the direction toward the lower jaw 35. The two jaws 33 and 35 also serve as a support for the internal wrapping to be applied to the compressed stack 11, as will be described below.

The apparatus for application of the outer wrapping on the stack has a flat support plate 49, which is supported on table 17 by means of a guide element 51 and a frame 52. The upper side of the support plate 49 lies in the same plane as the upper side of the lower jaw 55 of a second jaw pair (see Fig. 6), whose second jaw 53 is situated above the lower jaw. The two jaws 53 and 55 are each formed from a metal sheet and provided with V-shaped cutouts 57, in order to facilitate grasping and performance of the manipulations required for application of the wrapping onto the body. The lower jaw 55 is connected on its rear end to the frame 52 fastened to table 17. It has two upward bent side parts 59. The upper jaw 53 is provided with two downward directed side parts 61 that lie over the side parts 59 and cooperate with the latter. The upper jaw 53 is connected movably to table 17, so that it can be moved toward the lower jaw 55 or away from it, for which purpose it is mounted, by means of a mounting pin 63, in support 65. The

upper jaw 53 is under the influence of controllable springs 67, similar to springs 47, so that it is forced in the direction toward lower jaw 55. The spring 67 can optionally also be omitted.

As already mentioned, the pre-compressed stack 11 arrives in the re-loosened state on table 17. The stack 11 to be packed is applied to the extension 67a of the lower plate 25 of compression mold 19 and pushed into the space of compression mold 19 situated between the upper and lower plate 23 or 25. The belts 21, moving in the direction of the arrow shown in Fig. 1, grasp the stack 11 and guide it with a continuous increase in the pressure that causes shortening of the stack in its longitudinal direction, through the compression mold 19, in order to push it into the space bounded by the two jaws 33 and 35, in which loosening by expansion is rendered impossible by the jaws.

Prior to the aforementioned compression of stack 11 within compression mold 19, a tube-like wrapping 69, made of paper, fabric or other sheet-like material, is pulled over the two jaws 33 and 35, as shown in Figs. 1, 2 and 3. The length of this flat, rectangular wrapping 69 corresponds at least roughly to the width of the compressed stack 11, while its perimeter corresponds at least roughly to the perimeter of stack 11. The interior dimensions of the space enclosed by jaws 33 and 35 are at least roughly identical to the dimensions of the finished product. The mobility of the upper jaw 33, relative to the non-moving lower jaw 35 of the holding device, permits easy pushing of the wrapping 69 over the two jaws.

The two belts 21 force the compressed stack 11 into the space between the two jaws after the wrapping 69 has been pushed onto the latter. Because of the described design of the jaws 33 and 35 equipped with indentations 37, it is possible to simultaneously grasp the stack 11 and wrapping 69 by hand and remove it from the area of effect of the jaws without requiring opening of the two jaws. The two jaws can optionally be slightly forced against each other to facilitate this manipulation.

The wrapping 69 is snugly wrapped around stack 11, its longitudinal direction coming to lie parallel to the rib-like elevations formed by creping of the sheets, as shown in Fig. 8. The tube-like wrapping 69, which consists of a sheet, two opposite edges of which are joined at 71, is resistant enough to prevent expansion of the stack in its longitudinal direction at right angles to the longitudinal direction of wrapping 69. This wrapping 69, however, is not sufficient according to experience to rule out warping of the package or to prevent entry of air and moisture into the stack.

The body formed from stack 11 and the wrapping 69 situated on it is then placed by hand on plate 49, on which it lies with an open long side against guide 51, as shown in Fig. 1. From this position, the body is pushed between the two jaws 53 and 55 (Fig. 1, 5 and 6). In this position, the rib-like elevations of the sheets of the stack and the connection location 71 of the wrapping 69 run across the longitudinal direction of jaws 53 and 55, since the latter assume a position changed by 90° relative to the first jaw pair 33, 35. The second wrapping 73, designed as a sack and accordingly open only on one end, which is formed preferably from a strong kraft paper or another appropriate sheet-like material, is, as shown in Fig. 1 and 6, placed over the jaws 53 and 55. The longitudinal direction of the second wrapping 73 therefore lies at right angles to the longitudinal direction of the first wrapping 69 and the rib-like elevations of the individual sheets of stack 11. When the bottom of the second wrapping 73 abuts the side of the body, consisting of parts 11 and 69, lying parallel to it, the latter is removed by hand together with the second wrapping 73 from the area of the jaws 53 and 55, which is made possible by the V-shaped indentations 57 in the jaws. The end 75 of the second wrapping 73 protruding over the body 11, 69 is then folded and glued in known fashion over the body. The finished package is shown in Fig. 9. The dimensions of the second wrapping 73 are chosen, so that they smoothly fit the first wrapping.

The type of packing of a stack just described produces packages that correspond to all requirements, in terms of retention and shape and completely tight sealing of the contents against entry of moisture and air. This is attributed to the fact that the wrappings 69 and 73 each act on their own in two different directions, offset by 90° relative to each other, so that the tendency of the compressed stack to expand again in its longitudinal direction and, in so doing, allow a shape change by warping, is fully compensated. The arrangement of two wrappings has the further advantage that only the outer wrapping need be opened, in order to use the sheets, and the inner wrapping must be cut, whereupon any number of sheets can be removed from the stack and the package reclosed, which is of great importance for hygienic storage of the sheets.

The described method for packing can be conducted quickly. The apparatus described for this purpose is simple in design, so that it can be produced with relatively limited means.

The first wrapping, can also be formed as a sack of paper, a fabric or other sheet or film-like material, which offers special advantages in certain special cases. A package with a first wrapping designed in this way is shown in Figs. 10 and 11. This first wrapping element 77 has

at least roughly the same shape and the same dimensions as the compressed stack 11 formed from a plurality of superimposed individual sheets, which is contained in this first wrapping 77. This wrapping element 77 consists of a tube-like part, whose parts covering the side surfaces of the stack overlap each other, the overlapping edges 79 being joined to each other. The wrapping 77 also has on the one open end a closure flap 81, which can be wrapped around the side surface to form the sack and fastened to the latter in known fashion. The end of the sack opposite the closure flap 81 remains open, as shown in Fig. 11.

The wrapping element 77 is placed on the stack 11 in similar fashion, as described in the tube-like wrapping 69, that is, it is pulled over the two jaws 33 and 35, which are situated behind the compression mold 19 and are provided to accommodate the compressed stack 11. In this case as well, the longitudinal direction of the wrapping element 77 lies parallel to the rib-like elevations achieved by creping of the superimposed sheets of stack 11. The wrapping element 77 is then removed with the stack 11 and the closure flap 81 closed, whereupon a second sleeve 83 is similarly applied, as already described. The result is again a package, whose flat shape undergoes no change, is air-tight, and whose contents can be made sterile in known fashion.

The described package requires relatively little space and results in only an insignificant increase in weight of the stack. The stacks packed in the described manner retain the compact shape produced by compression until use of the individual sheets, in order to expand again to the form before compression as soon as the wrappings are removed or the sheets are taken out of the wrappings. It was found that the sheets, after expansion, possess their original properties, with reference to low density and high absorption capability for liquids, to an unaltered extent.

The package can be used for stacks that consist of superimposed flat, thin, creped sheets or layers of cellulose fibers, said sheets or layers can also have been treated in known fashion, so that they correspond to certain requirements with reference to sterility and absorption capacity.

CLAIMS:

I. Method for production of packages from stacks consisting of creped sheets of cellulose fibers, characterized by the fact that these stacks are subjected to compression at right angles to the rib-like elevations formed by creping with at least approximate maintenance of the height and width of the stack, whereupon a first wrapping is placed on the stack and then a second wrapping

over it, so that the longitudinal direction of the first wrapping runs parallel to the rib-like elevations of the sheets of the stack, while the longitudinal direction of the second wrapping runs at right angles to the mentioned rib-like elevations, and the compressed package retains its flat shape in the compressed state, but after opening of the package, the individual sheets can be brought to their original form before compression.

II. Apparatus for performance of the method according to Claim I, characterized by a compression device for compression of a stack passed through it, a pair of clamping devices arranged behind the outlet side of the compression device to accommodate the stack after leaving the compression device, as well as for application of a first wrapping, and a second pair of clamping devices to accommodate the compressed stack provided with the first wrapping, as well as for application of a second wrapping.

III. Package produced according to the method according to Claim I, characterized by the fact that it has a first wrapping, consisting of a sheet-like material, lying across the direction of the rib-like elevations of the sheet of the stack, around which a second wrapping formed from a sheet-like material is placed, whose longitudinal direction lies at right angles to the longitudinal direction of the first wrapping, so that the first wrapping counteracts expansion of the stack, while the second wrapping counteracts a shape change, in order to keep the compressed, wrapped stack flat.

DEPENDENT CLAIMS:

1. Apparatus according to Claim II, characterized by the fact that the compression device is formed from two superimposed plates, between which two belts forming the side walls are arranged, so that they delimit a wedge-like passage for the stack, said belts simultaneously serving as transport and compression device for the stack and guiding it from the entry site to the outlet site with continuously increasing lateral compression.

2. Apparatus according to Claim II and dependent Claim 1, characterized by the fact that the belts are moved by a drive device in the same direction and are supported along their path under the two plates for straight guiding during compression.

3. Apparatus according to Claim II and dependent Claims 1 and 2, characterized by the fact that it has two pairs of holding devices, each pair of which consists of two flat parts with two

side parts bent at right angles, which are fastened on one end to support devices, so that for each pair one part can be pivoted toward the other part or away from it.

4. Apparatus according to Claim II and dependent Claims 1 to 3, characterized by the fact that the space situated between the two holding devices has a rectangular cross-section, and that the two holding devices are provided with indentations that permit grasping and removal of a stack situated between the devices without requiring opening of the devices.

5. Apparatus according to Claim II and dependent Claims 1 to 4, characterized by the fact that one holding device is arranged directly at the outlet site of the compression device for the purpose of accommodating the stack after completion of the compression process and ejection from the compression device.

6. Package according to Claim III, characterized by the fact that the inner wrapping has the form of a flat, rectangular tube, whose dimensions are chosen so that, after application onto the compressed stack, it lies against the latter and does not protrude beyond the stack on the two open ends.

7. Package according to Claim III and dependent Claim 6, characterized by the fact that the outer wrapping has the form of a flat, rectangular sack open on one end, whose dimensions are chosen so that, after insertion of the stack provided with the internal wrapping, it lies against this internal wrapping, and that the open end of the sack lies over one open end of the inner wrapping and can be closed.

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Company
Representative: Fritz Fricker, Zurich.

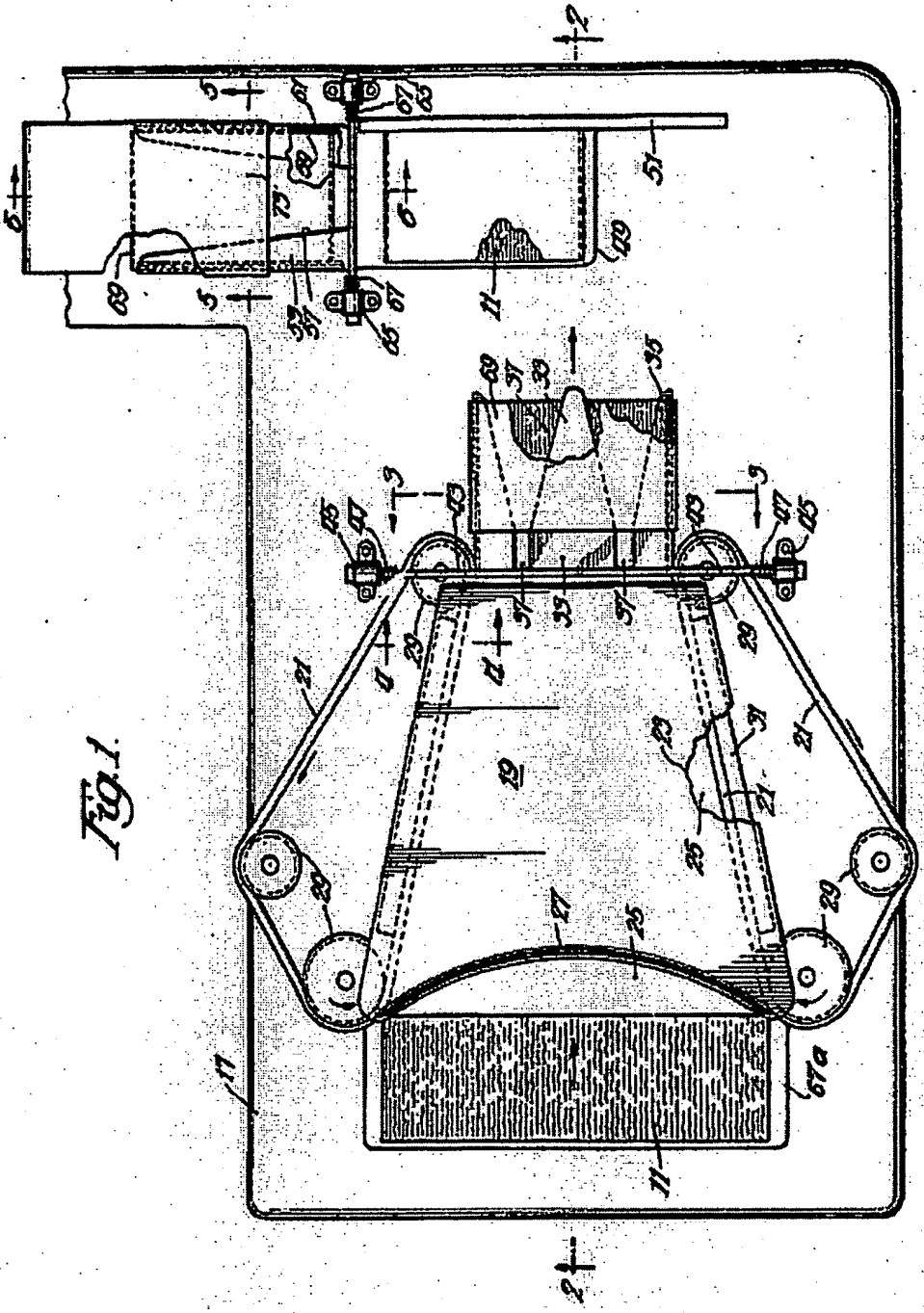

Fig. 1.

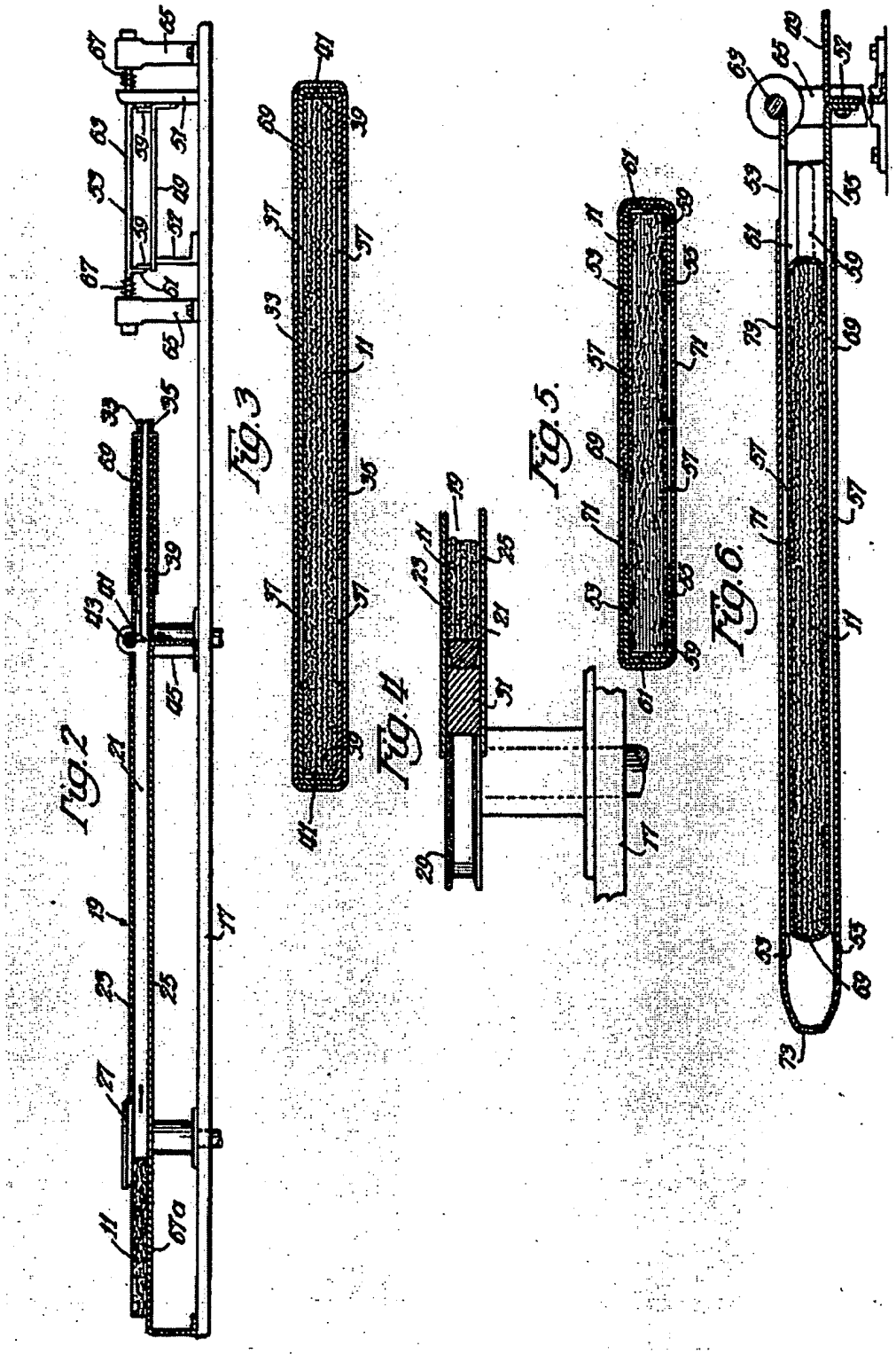

Fig. 2

Fig. 3

Fig. 4

Fig. 5.

Fig. 6.

Fig. 7

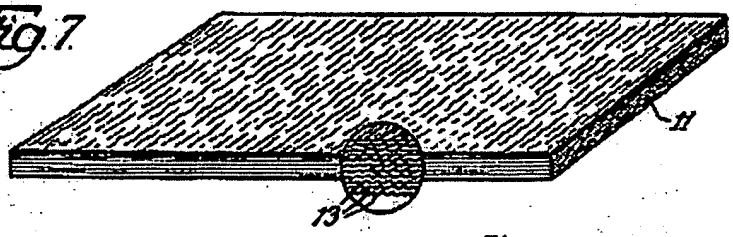

Fig. 8

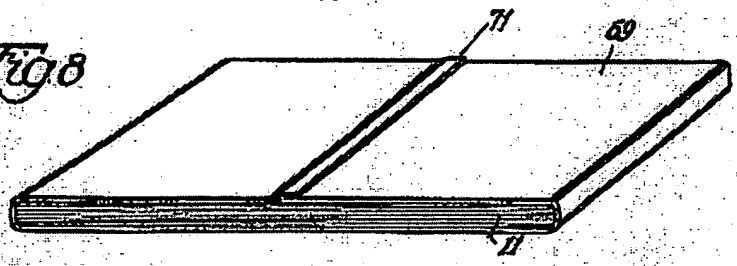

Fig. 9

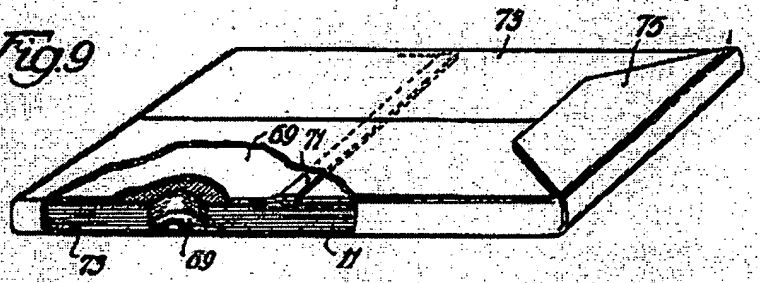

Fig. 10

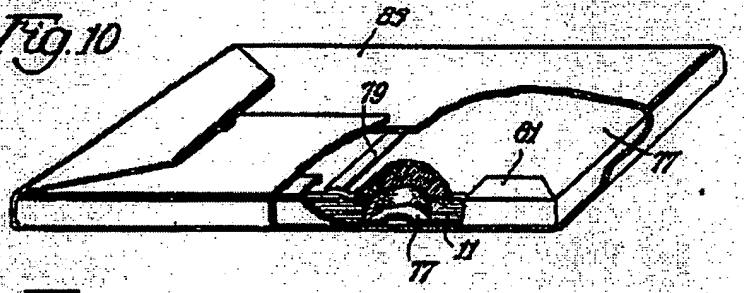

Fig. 11.